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# PHASE 1 SAMPLING AND ANALYSIS PLAN FOR 200-IS-1 OPERABLE UNIT TANK FARM PIPELINES

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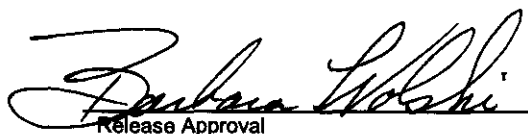
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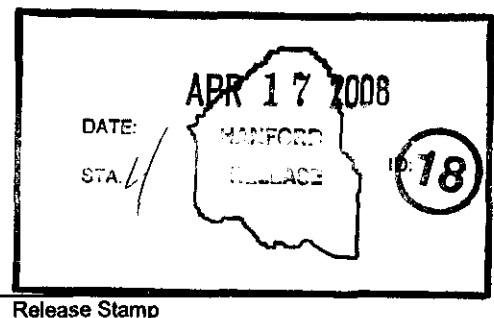
**Abstract:** Requirements for sampling and analysis of a number of tank farm pipelines and surrounding soil within the 200-IS-1 operable unit are specified. Data obtained based upon this sampling and analysis plan will be used to support development of the Remedial Investigation/Feasibility Study for the operable unit.

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## LIST OF TERMS

CH2M HILL	CH2M HILL Hanford Group, Inc.
CFR	<i>Code of Federal Regulations</i>
DOE	U.S. Department of Energy
DQO	data quality objective
Ecology	Washington State Department of Ecology
EMI	electromagnetic induction
EPA	U.S. Environmental Protection Agency
GPR	ground penetrating radar
HFFACO	<i>Hanford Federal Facility Agreement and Consent Order</i>
IC	ion chromatography
ICP/AES	inductively coupled plasma/atomic emissions spectroscopy
OU	operable unit
PCB	polychlorinated biphenyl
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RPP	River Protection Project
SAP	sampling and analysis plan
SST	single-shell tank
SVOA	semivolatile organic analysis
SVOC	semivolatile organic compound
TIC	tentatively identified compound
PSAP	Pipeline sampling and analysis plan
VOA	volatile organic analysis
VOC	volatile organic compound
WIDS	Waste Information Data System
WMA	Waste Management Area



## 1.0 SAMPLING AND ANALYSIS OBJECTIVES

The primary objective for sampling and analysis of the pipelines and contaminated soil in the 200-IS-1 Tanks/Lines/Pits/Waste Group Operable Unit (OU) is to provide characterization data for remedial investigation/feasibility study and remediation decision-making.

Sampling and analysis requirements were defined using a data quality objective (DQO) process. The Washington State Department of Ecology (Ecology), the U.S. Department of Energy (DOE) and its contractors participated in the DQO process. Results of the DQO process are documented in the *Data Quality Objectives Summary Report for the 200-IS-1 Operable Unit Pipelines and Appurtenances* (D&D-30262).

This sampling and analysis plan (SAP) summarizes the DQO requirements and provides additional direction and clarification for field screening, sampling, laboratory analysis, and data reporting for meeting the requirements. Specifically, the SAP covers the DQO requirements for chemical and radiological characterization. Operational sampling and analysis requirements will be documented in pipeline and associated soil sampling and analysis plans (PSAPs). A PSAP will be prepared for an individual pipeline (or a group of pipelines) and associated areas of contaminated soil in accordance with approved CH2M HILL Hanford Group, Inc. (CH2M HILL) procedures. The PSAPs will meet requirements in this SAP.

## 2.0 BACKGROUND

The 200-IS-1 OU consists of *Resource Conservation and Recovery Act* (RCRA) (EPA 1976) past-practice waste sites and treatment, storage, and disposal units. The OU designation and waste site assignments are defined in DOE/RL-96-81, *Waste Site Grouping for 200 Areas Soil Investigations*, and DOE/RL-98-28, *200 Areas Remediation Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program*. The OU includes an extensive network of pipelines, diversion boxes, catch tanks, valve pits, related infrastructures, and associated unplanned releases. The systems were used to transport waste or process materials from separation facilities to the single-shell and double-shell tanks and to control or divert flow to disposal waste sites that received liquid waste streams. The process-waste pipeline systems are located primarily within the industrial 200 Areas of the Hanford's Central Plateau.

## 3.0 SCOPE

The scope of this SAP is limited to the 200-IS-1 OU pipelines and contaminated soil. Sampling and analysis of other equipment in the OU will be addressed at a later date. Also, this SAP is applicable only to the approximately 300 individual pipelines that are being managed by CH2M HILL for the U. S. Department of Energy. These pipelines are located outside tank farms (e.g., facility to diversion box, tank farm to tank farm, etc.). They do not include those located within tank farm fences. Identification of pipelines has been performed by examining drawings and other documentations. Pertinent information for these pipelines are entered into the Waste

Information Data System (WIDS) (Fluor 2007). Additional pipelines may be identified by future field walk-downs or excavations. A separate SAP is used to address characterization needs for facility process pipelines within the 200-IS-1 OU that are managed by Fluor Hanford, Inc.

In accordance with the DQO (D&D-30262), characterization of the pipelines will be performed in two phases. In Phase 1, data will be collected for piping and soil where existing knowledge indicates contamination is likely present. The goal of Phase 1 sampling is to determine whether or not contamination is above preliminary cleanup levels. In addition, data will be collected in Phase 2 to support remediation decision making including a no-action decision. It is expected that Phase 2 would require a much larger data set. This SAP only addresses Phase 1 sampling. Additional Phase 1 sampling may be required after reviewing the results for the sampling outlined in this SAP prior to moving to Phase 2.

## **4.0 SAMPLING REQUIREMENTS**

### **4.1 SAMPLING AND ANALYSIS APPROACH**

The approximately 300 tank farm pipelines comprise of over 400,000 ft of pipes. Levels of contamination are expected to be different among individual pipelines and could vary significantly within a pipeline. Therefore, direct characterization of the 400,000 ft of piping is not practical. A sampling approach has been developed to take maximum advantage of existing knowledge and waste sample data to optimize pipeline sampling.

The pipelines were used to transfer waste or process materials from facilities such as the Plutonium-Uranium Extraction Plant (PUREX), Reduction-Oxidation Plant (REDOX), B Plant, T Plant, U Plant, tank farm evaporators (242-B, 242-T, 241-S, and 242-A), processing vaults (244-AR, 244-BXR, 244-CR, etc.) and Hot Semiworks. Wastes generating from many of these facilities are well known based on knowledge of facility operations. The wastes were transferred for storage primarily in the Hanford tank farms. Wastes stored in the tank farms are relatively well characterized by extensive sampling and thorough review of waste generating and transfer history. However, little or no sampling has been performed on the residual waste that may be present in the transfer lines. Also, a review of existing documentation to develop process knowledge for the pipelines is still ongoing. Presently, little is known about past duties (i.e., what wastes was transferred through which pipelines) of many pipelines.

Therefore, characterization of contamination in the pipelines will be needed to support RI/FS and remediation decision-making. As discussed previously, the primary objective of Phase 1 sampling is to determine whether or not contamination in a pipeline and in surrounding soil is above preliminary cleanup level. Secondary objectives include:

- Evaluate and demonstrate sampling and field measurement methods and technologies.
- Evaluate process history associated with these pipelines.
- Refine current conceptualization of waste associated with the pipelines, associated encasements, and soils.
- Collect data that may be used to develop sampling approach for Phase 2.

To achieve the above objectives, it is desirable that pipelines selected for Phase 1 sampling have the following attributes:

1. The pipelines experienced failures such as leaking or plugging. Contamination in the pipe or surrounding soil likely exceeds preliminary cleanup levels.
2. The selected pipelines represent both direct-bury pipelines and encased pipelines. These conditions present different challenges for sampling. Selection of these pipelines will allow demonstration of sampling methods for different conditions.
3. The pipelines were constructed from pipes made of different material (e.g., a stainless steel pipe welded to a carbon steel pipe). The mismatch of construction increases the likelihood

that a leak may have occurred and, therefore, the pipe and surrounding soil may have elevated levels of contamination.

4. The pipelines were used to transfer waste known to have high level of contamination. This increases the likelihood that contamination in the pipe exceeds cleanup levels.
5. The pipelines represent a group of lines used to transfer the same waste. Because composition of the waste transferred through a group of lines generally can be developed based on process knowledge and existing tank sample data, sample data obtained for one or two pipelines in a group will provide information regarding contamination in the other pipelines. This information may be used to guide additional Phase 1 sampling or to optimize Phase 2 sampling.

Each pipeline selected for Phase 1 will be sampled at a minimum of three locations. Both pipe and surrounding soil will be sampled at the selected locations. Contamination measurements at three different locations in a pipeline will provide information on the distribution of contamination along the length of a pipeline.

In addition to the pipelines having the attributes discussed above, the lines will be sampled at locations where contamination is most likely to accumulate. Examples of these types of location are listed below:

1. Low point in the line,
2. At the end of a long run with low slope,
3. Point where a leak occurred,
4. A transition point (e.g., bend, elbow, etc.), and
5. Point where there is a mismatch of pipe-construction materials.

Also, many of the pipelines can be accessed for sampling only by significant excavation; therefore, it is desirable that multiple pipelines be accessible at an excavation location. Each sample location will have one or more of the attributes.

Two pipelines that satisfy the above desired attributes are selected for Phase 1 sampling: V108/812 and V108/8653/8618. Pipeline V108/812 is a 3-inch diameter, carbon steel, direct buried transfer line. Pipeline V108/8653/8618 is a 3-inch diameter, stainless steel, encased line. The lines are 1420 and 6840 ft long, respectively. V108/812 was used to transfer primarily PUREX supernatant or PUREX sludge supernatant from the 244-AR Vault to the 241-C-151 diversion box. V108/8653/8618 was used to transfer PUREX acid sludge from the 244-CR Vault to the 221-B Plant. A leak was known to occur in 1971, likely near where the lines are welded together. Additional details on the pipelines can be found in the Waste Information Data System (WIDS), Site Codes 200-E-153-PL and 200-E-111-PL, respectively.

Sample locations for these two pipelines are shown in Figure 4-1. Note that samples to be taken at location 1 will be used for both pipelines. The desired attributes associated with each sample location are shown in Table 4-1. The selected sample locations may not be accessible because of unexpected radiation level or equipment configuration encountered in the field. In that event, alternate sample locations will be selected after a discussion with Ecology personnel. Changes to the sample locations will be documented in the appropriate PSAP.

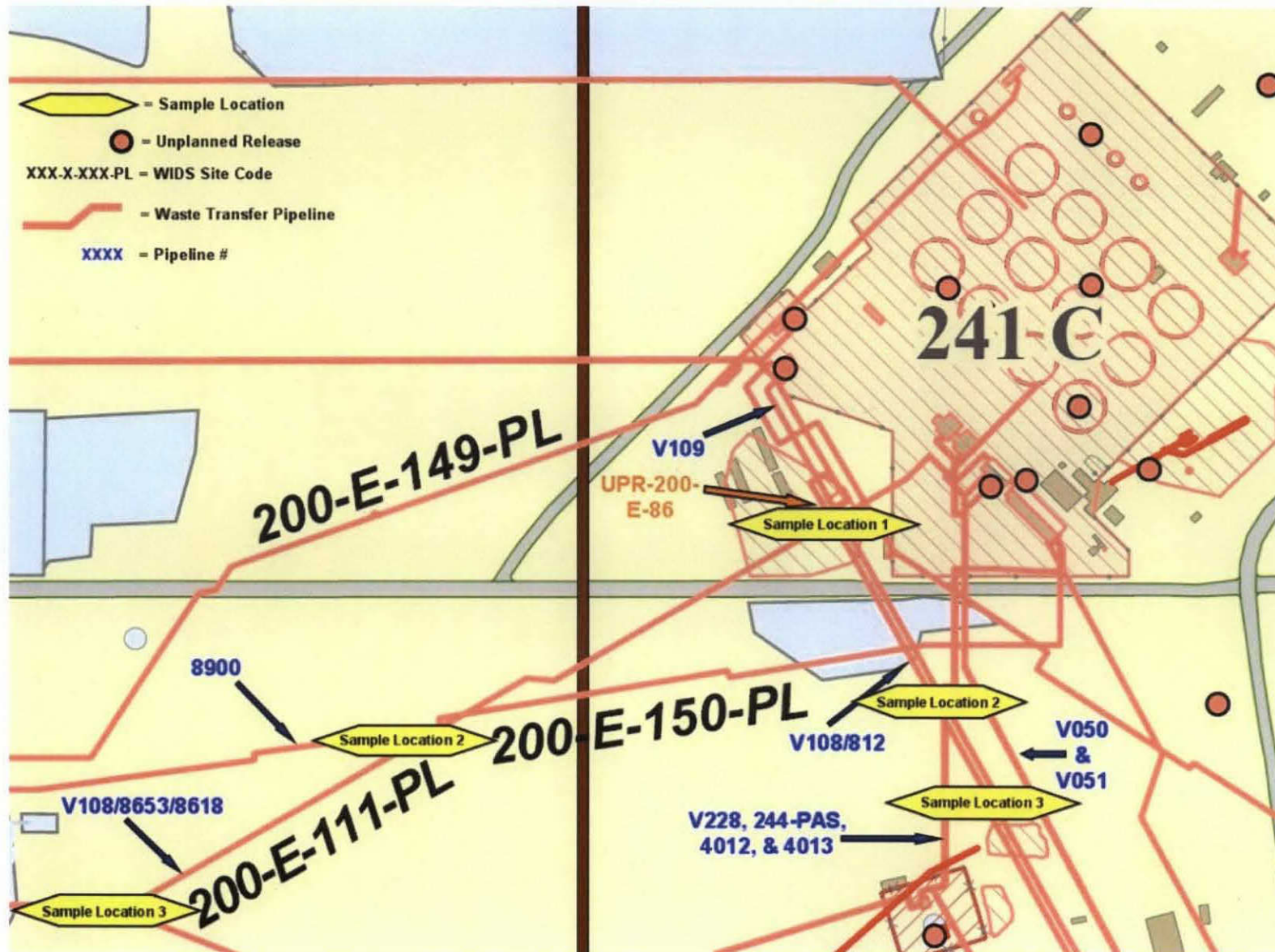


Figure 4-1. Phase 1 Tank Farm Pipeline Sample Locations

**Table 4-1. Pipeline and Sample Location Attributes**

Pipeline - Sample Location	Attributes									
	Known Leak	Low Point in Line	End of Long Run with Low Slope	One of a Number of Pipelines Used to Transfer the Same Waste <sup>1</sup>	At a Transition Point in Pipeline (e.g., Bend, Elbow)	Direct Buried Line	Encased Line	Construction Material Mismatch	Access to Multiple Lines at One Sample Location	Carried Waste Known to Have High Level of Contamination
V108/812 and V108/8653/8618 Sample Location 1	X	X	X	X	X	X	X	X	X	X
V108/812 Sample Location 2		X		X		X			X	X
V108/812 Sample Location 3		X		X		X			X	X
V108/8653/8618 Sample Location 2		X		X			X		X	X
V108/8653/8618 Sample Location 3		X		X			X		X	X

<sup>1</sup>V108/812 was used to transfer PUREX supernatant. Other pipelines that carried the same waste include V109, V130, 8902, and 4012. V108/8653/8618 was used to transfer PUREX acid sludge. Other pipelines that carried the same waste include V228 and 8901/8649/244.



Sampling at each location will be based on a conceptualization of residual waste in the pipelines. The conceptualizations of residual waste for intact and failed, direct-buried pipelines, encased pipelines, and encasements are shown in Figures 4-2. In general, contamination in the residual waste is likely a result of solids settled out on the bottom of the pipelines and insoluble constituents deposited on the pipe wall during operation. Contaminants in the residual waste are most likely insoluble metal cations (such as silver, bismuth, aluminum, iron, manganese, chromium, mercury, lead, silicon, and zirconium), insoluble radionuclides (such as strontium-90, uranium isotopes, actinides, and cobalt-60), soluble salts (such as sodium and potassium), and soluble radionuclides (such as cesium-137, iodine-129, and technetium-99). In cases where pipelines failed due to plugging, contaminants include both soluble and insoluble constituents of the waste that was transferred when plugging occurred.

Soil at each sample location will be characterized. Soil sampling is expected to be simpler than pipeline sampling. Therefore, soil will be collected by grab sampling at multiple depths and sent to a laboratory for analyses (see Section 5.0 for analytical requirements). One or more of the soil sampling methods described in Section 4.2.2 may be used. The number of grab samples and the location and depth of each grab will be based on field screening (e.g., surface radiation survey, ground penetration radar, etc.) and depth of the pipeline. Location and depth of soil grab samples will be specified in the appropriate PSAP.

Pipeline sampling poses significant difficulties and exposure to the workers. Therefore, the approach for pipeline sampling and analysis is somewhat different from soil sampling. At the first sample location for each pipeline, a section of pipe will be removed and sent to the laboratory for analysis of residue. Total length of the section of pipe removed is limited to 10 ft or less, based on a desire to limit excavation and for As Low As Reasonably Achievable (ALARA) concerns. Actual length of piping removed will be based on field survey results. The pipe section may be cut into smaller sub-sections for ease of shipping and handling.

Residual waste on the interior of the pipe (and between the primary and secondary pipe, if the pipe is encased and the primary pipe failed) will be removed and analyzed as required in Section 5.0. Liquids, if present in the pipeline, will be collected in sample jar(s) and shipped to a laboratory for analysis. If the amount of the sample material is insufficient for analysis of all constituents listed in Table 5-1, then only the constituents most likely to be present, as discussed above, will be analyzed. If the amount is insufficient even for these analytes, then DOE and Ecology will evaluate additional changes to the list of analyses. Changes to the analyses will be documented in the appropriate PSAP.

At the other sample locations for a pipeline, either field-deployed measurements or laboratory non-destructive assay (NDA) of a short section of pipe will be used to obtain limited data. These data may be used directly to confirm whether or not contamination in the pipeline exceeds cleanup levels. For example, if gamma energy data obtained with a field instrument or NDA indicates cesium-137 exceeds its cleanup level, then no further evaluation is necessary. This is a possible scenario for V108/812 because this pipeline was used to transfer PUREX supernatant, which is known to have high level of this radionuclide.

Field measurement or NDA data may be used indirectly also. If cesium-137 concentration is below its cleanup level, then concentration of other COPCs at these locations may be estimated by the use of scaling factors (concentration ratios of other constituents to cesium-137). First, a scaling factor is developed for each constituent using sample results from the first sample location. Second, obtain cesium-137 concentration of the residual waste in a pipe by using field gamma measurements or NDA. Third, estimate concentration of the other COPCs by scaling the measured cesium-137 concentration at each location. This is a possible scenario for V108/8653/8618 because this pipeline carried PUREX acid sludge, which has a relatively low level of cesium-137 but high levels of actinides and strontium-90.

After completion of sampling, the pipeline and the surrounding soil will be placed in a state that is protective of the worker and environment. Activities to achieve the end state will depend on sample location and sampling methods used. Guidance for achieving the end state after sampling will be provided in the PSAP.



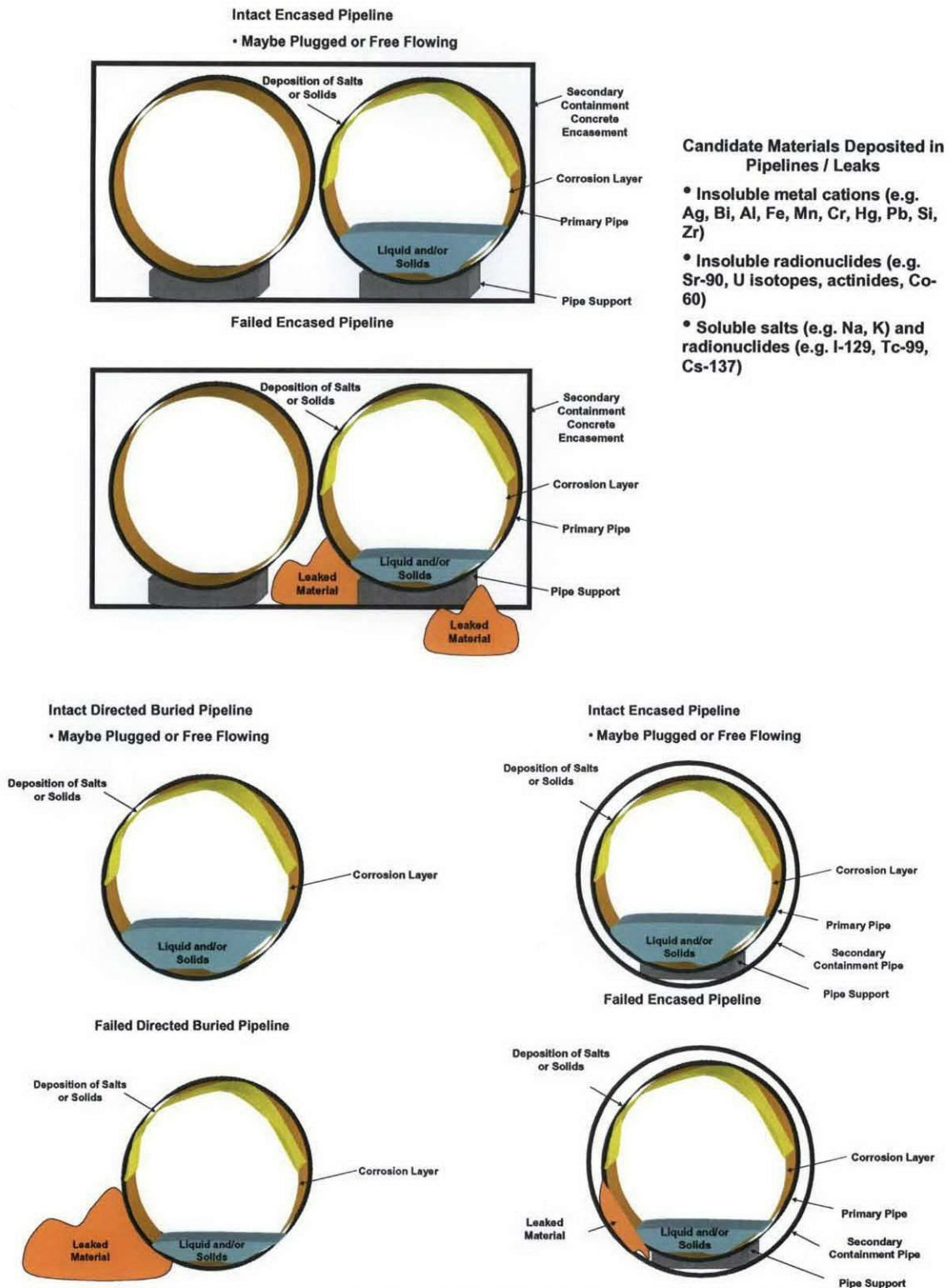


Figure 4-2. Conceptualization of Residual Waste in Process Pipelines

## **4.2 SAMPLING METHODS**

Characterization activities include evaluation of the interior of pipelines and adjacent vadose zone soil. Within the interior of pipelines, samples of residual solids in the form of sediment, sludge or scale and liquid, if present, will be collected. For soil, sampling and geophysical logging using spectral and gross gamma, passive neutron, and active neutron (moisture) detectors will be performed. Direct-push technology (e.g., Geoprobe or equivalent equipment) will be used for vadoze soil sampling and geophysical logging. The sampling strategy is designed to provide focused evaluations on potentially contaminated locations and media inside the pipelines, and in adjacent subsurface soils where leakage may have occurred. Selection of samples in soils used for laboratory analysis will be guided by field screening results. Field screening results will assist in identifying the sample depths where the most extensive contamination occurs.

Prior to implementing intrusive activities, surface geophysical and radiation surveys will be conducted at all sample locations. The surface geophysical surveys will be conducted using ground-penetrating radar and/or electromagnetic induction and will aid in verifying buried pipeline locations, other buried utilities, and subsurface anomalies. Surface radiation surveys will identify areas of surface contamination that might impact the intrusive activities and health and safety requirements.

Sampling and field-deployed measurement methods that may be used are described in Sections 4.2.1 and 4.2.2 for piping and soil, respectively. The specific methods to be used at a sample location will be identified in the appropriate PSAP. The PSAP also will provide additional guidance for excavation and preparation of the samples for shipping to and receiving at the laboratory.

### **4.2.1 Pipeline Sampling**

#### **Handheld and Deployed Instrument Radiological Surveys:**

Radiological surveys of pipeline interiors will be used to provide information concerning the presence or absence of residual radiological contamination. A number of deployment systems are available; some include a configuration with camera survey equipment. Alpha, beta, and gamma radiation detectors can be used with some systems. Equipment and survey specifications will be presented in the PSAP(s). Alternatively, a short section of pipe may be removed for NDA at a laboratory.

#### **Sampling Pipe Scale/Sediment Sludge for Laboratory Analyses:**

Residual build-up of sediment, slug, or scale may be present in the interiors of pipelines. Liquid may also be present in some pipelines. These materials will be sampled at one location per pipeline. A section of pipe, up to maximum of 10ft long, will be removed and sent to a laboratory for analysis. As discussed earlier, the pipe section may be cut into smaller sub-

sections for ease of handling. Liquid, if present, will be collected in sample jar(s) and shipped to a laboratory for analysis.

A hydraulic-type cutting tool, similar to the “jaws of life” has been used to cut piping jumpers at tank farm underground valve pits, as well as at the Hanford 100K Area, to remove piping. This hydraulic shear is capable of cutting a pipe with a diameter up to 6 inches. Additionally, there are commercially available tools that mount on the outside of piping. These tools not only can cut the pipe pneumatically but also prepare the ends for handling. This could significantly reduce worker exposure.

#### **4.2.2 Soil Sampling and Survey Methods**

Investigations for the presence of contaminants in the soils surrounding pipelines will be conducted using both indirect and direct evaluation techniques. Subsurface investigations will include geophysical logging and soil sampling. One or more of the following sampling and survey methods may be used to characterize soil contamination:

##### **Direct-Push Investigative Techniques:**

Subsurface investigations using direct-push technology will be employed as part of the assessment for soil surrounding selected pipeline locations. This technology can be used to install casing and collect samples with minimal to no excess waste soil generated. Installations will be used to obtain information relating to a number of in situ soil characteristics including gamma radiological levels and soil moisture. Discrete sample intervals will have soil collected for field screening and laboratory analyses. This technology will work well in the unconsolidated sediments and fill material adjacent to buried pipelines.

##### **Geophysical Logging Through Direct-Push Casing**

Radioactivity levels will be measured in soils using geophysical logging instrumentation. Radioactive contamination is generally expected to be primarily represented by gamma emitters (e.g., cesium-137). Driven small-diameter casing will be installed and used for down-hole logging with gamma-logging tools. The depth of a driven casing will be limited by the subsurface conditions (i.e., cobbles or gravel). Gross gamma and passive neutron logging probes will be used to determine areas of potentially high americium-241 and plutonium-239/240 concentrations. The small-diameter gross gamma and passive neutron probe system uses bismuth-germanium detector instrumentation for gross counting of the gamma-emitting radionuclides in the soil as a function of depth. The passive neutron logging instrument with a nHe-3 detector can be configured to detect the neutron flux present in the below-ground soil environment. Active neutron logging will be used to determine soil moisture content. Soil moisture will be reported as a percent volume fraction.

#### **4.2.3 Surface Geophysical Techniques for Pipeline Evaluations**

Several geophysical techniques are available and will be used as needed to gather information on buried pipelines. Additional discussion on surface geophysical techniques is provided in EPA/625/R-92/007, *Use of Airborne, Surface, and Borehole Geophysical Techniques at Contaminated Sites: A Reference Guide*.

## **Magnetometry**

Magnetometers permit rapid, non-contact surveys to locate buried metallic objects or features. This technique is applicable for use with buried metal pipelines. Portable (one-person) field units can be used virtually anywhere that a person can walk, although they can be sensitive to local interferences, such as fences and overhead wires. Field-portable magnetometers may be single- or dual-sensor. Dual-sensor magnetometers are called gradiometers; they measure gradient of the magnetic field; single-sensor magnetometers measure total field. Magnetic surveys typically are run with two separate magnetometers. One magnetometer is used as the base station to record the earth's primary field. The other magnetometer is used as the rover to measure the spatial variation of the earth's field. The rover magnetometer is moved along a predetermined linear grid laid out at the site.

## **Ground-Penetrating Radar and Electromagnetic Induction**

Surface geophysical surveys using ground-penetrating radar (GPR) and electromagnetic induction (EMI) techniques will be used to verify the locations of pipelines as needed. GPR uses a transducer to transmit frequency module electromagnetic energy into the ground. Interfaces in the ground, defined by contrasts in dielectric constants, magnetic susceptibility, and, to some extent, electrical conductivity, reflect the transmitted energy. The GPR system measures the travel time between transmitted pulses and the arrival of reflected energy. The reflected energy provides the means for mapping subsurface features of interest. The display and interpretation of GPR data are similar to those used for seismic reflection data. When numerous adjacent profiles are collected, often in two orthogonal directions, a plan view map showing the location and depth of underground features can be generated.

The EMI technique is a non-invasive method of detecting, locating, and/or mapping shallow subsurface features. It complements GPR because of its response to metallic subsurface anomalies and because it provides reconnaissance-level information over large areas to help focus GPR activities. The EMI techniques are used to determine the electrical conductivity of the subsurface and generally are used for shallow investigations. The method is based on a transmitting coil radiating an electromagnetic field that induces eddy currents in the earth. A resulting secondary electromagnetic field is measured at a receiving coil as a voltage that is linearly related to the subsurface conductivity.

## **Surface Geophysical Exploration**

Surface geophysical exploration can be used to extend the current level of understanding associated with subsurface contamination by providing spatial distributions that can be correlated with other characterization data. Resistivity data are sensitive to salts such as sodium nitrate, one of the major constituents in tank waste.

Electrical geophysical methods apply an electrical current to the ground and measure the voltage potential at another location. By using multiple electrodes at different locations, regions of lower resistivity can be mapped and subsequently interpreted as possible waste plumes. Because of concerns over possible interference from tanks, piping, and other infrastructure, different combinations of resistivity data may need to be collected such as surface lines, wells (including drywells), and a combination of well-to-surface lines. In addition several geophysical methods should be used to identify the presence and location of buried infrastructure as a prerequisite to

collecting the resistivity data. Infrastructure mapping should use a variety of methods including magnetic gradiometry, electromagnetic induction, and ground-penetrating radar. The infrastructure map will be used during the analysis and interpretation of the resistivity data to differentiate between the effects of buried infrastructure from the effects of subsurface contamination. See RPP-RPT-28955, *Surface Geophysical Exploration of T Tank Farm at the Hanford Site* for additional information.

#### **4.3 SAMPLE CUSTODY**

A chain-of-custody form shall be used for each sample and will accompany each sample from sampling through analysis. At a minimum, the following sampling information shall be included on the chain-of-custody form:

- Project name
- Signature of the collector
- Date and time of collection
- Sample type (e.g., pipe, soil, etc.)
- Requested analysis or provide a reference for sample analysis
- Signatures of persons involved in the chain of possession
- Date and time of possession
- Unique sample identification number assigned to the sample
- Location from which the sample was obtained
- A notation of pertinent sampling information including unusual characteristics or sampling problems
- A brief description of the sample matrix such as color or consistency if possible.

Each sample will be shipped to the laboratories in an approved shipping container per approved procedure. A custody seal will be affixed to the lid of each sample container.

The information documented on the chain-of-custody forms should match the instructions within the PSAP. Sampling activities are documented in the work package(s), and any deviations from the PSAP instructions, and the justification for the deviations, will be captured in the work package. Sample integrity and traceability are maintained via the chain-of-custody forms, which are included in the Format V laboratory report. The Format V laboratory report includes a narrative section that documents known deviations from the PSAP requirements. A description

of the Format V report is provided in Section 7.0.

## **5.0 LABORATORY ANALYSIS REQUIREMENTS**

This section specifies requirements for laboratory analysis of pipe and soil samples. Because many of the samples are expected to be radioactive, analysis of the samples will be performed at DOE laboratories. The laboratories shall maintain a quality program that meets the requirements in Section 6.0. Sample handling requirements are provided in Section 5.1. Analytical requirements are specified in Section 5.2.

### **5.1 SAMPLE HANDLING REQUIREMENTS**

The laboratory shall remove sample material from each section of pipe or soil jar as necessary and place it in an individual empty jar (i.e., material from individual samples shall be stored separately). Solids removal methods that may alter chemical characteristics of the sample material (e.g., rinsing) shall not be used. Liquid samples may be kept in the same jars as received. Each sample shall be weighed and the approximate net weight recorded. Close-up photographs of materials in each jar shall be taken. The photographs should show, as clearly as possible, the physical characteristics of the sample.

The laboratory will observe and record the following sample characteristics:

- Color and consistency of solid samples
- Color and clarity of liquid samples (if present)
- Suspended or settled solids in liquid samples, if present (volume of solids will be estimated as a percentage of the sample total volume).

### **5.2 METHODS AND REQUIREMENTS FOR ANALYSIS**

Analytical requirements for pipeline and soil samples are summarized in Table 5-1. Pipe residue (liquid and solids) and soil samples will be analyzed for major constituent categories (VOCs, SVOCs, inorganics, and radionuclides) using specified analytical methods. Waste analyses will be performed utilizing the methods outlined in SW-846, where applicable. However, SW-846 methods may require some deviation to address radiological concerns and unique matrix conditions. All attempts will be made to meet the DQO requirements.

Constituents measured by the specified analytical methods are divided into primary and secondary analytes. Primary analytes are identified in Table 5-1 (and Table 5-2 for organic analytes) and categorized as such if they are included in any of the following:

- The SST Part A Permit (Part A) tank waste inventory

- Underlying hazardous constituents listed in WAC 173-303-610, “Closure and post-closure”; or Title 40, *Code of Federal Regulations*, Part 268, “Land Disposal Restrictions” (40 CFR 258) (40 CFR 268.48, “Universal treatment standards”)
- Radionuclides from 10 CFR 61, “Licensing Requirements for Land Disposal of Radioactive Waste” (10 CFR 61.55, “Waste classification”)

Primary constituents will be analyzed to the quality control (QC) requirements specified in the DQO. Secondary constituents are measured by the same analytical methods but are not required to meet the specified QC requirements.

Some constituents may be measured by more than one method. In these cases, the selection of the method may depend on the action levels required for a decision, the expectation that the constituent is present, or the detection limit that can be achieved for each method.

Hexavalent chromium concentration will be estimated by total chromium measurements. If total chromium concentration measurements exceed applicable threshold for hexavalent chromium, then analysis of hexavalent chromium will be performed.

For organic analyses, tentatively identified compounds (TICs) will be identified using the Reconstructed Ion Chromatogram. The Reconstructed Ion Chromatogram is evaluated for TICs by identifying peaks that have not already been identified as target compounds according to the following criteria. The criteria discussed below are from the proposed language for revision three of Volume 4 of DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Documents*.

The library match for a TIC should be higher than 75% before this detailed evaluation is initiated. The method-specified tune criteria should be met. Special attention to the tune at low masses should be taken when evaluating volatile compounds. The concentration of a TIC should be greater than 10% of the nearest internal standard or estimated 5 nanogram on column injection, whichever is smaller. Early (injection peak) and late eluting peaks (column bleed and coeluting compounds) should have adequate background subtraction to permit use of these TIC criteria. If isotopic patterns are present, the mass ratios should agree with the reference spectrum within 10%. The base mass peak for the sample should be the same as the reference spectrum. If a molecular ion is present in the reference spectrum, the sample should also have a molecular ion mass. Reference spectrum ions greater than 20% should be in the sample spectrum. Sample ions greater than 20% that are not in the reference spectrum need to be evaluated. Major sample ions (greater than 20%) should match relative intensities to the base peak to those same ratios for the reference spectrum within 10-30%.

The TIC evaluation is limited to the 30 largest TICs for the volatile organic analysis and the 30 largest for the semivolatile organic analysis meeting the criteria discussed above.

**Table 5-1. Chemical, Radiological, and Physical Analytical Requirements for Samples. (3 sheets)**

Instrument	Analyte	EPA Analytical Method	Prep method for solids (a/d/f/m/w/e/dist)	Quality control					
				Duplicate per Pipeline	Matrix spike	Matrix spike DUP	Blank	LCS	Units (for liquids or solids as appropriate)
Gravimetric	Bulk density or SpG <sup>1</sup>	Not available	d	One pipe and one soil samples	NA	NA	NA	ea AB	g/mL or unitless
Thermogravimetric	Wt% H <sub>2</sub> O	Not available	d	One pipe and one soil samples	NA	NA	NA	ea AB	wt%
ICP/AES	Primary inorganics (Ag, Al, As, Ba, Be, Cd, Co, Cr, Cu, Fe, Pb, Mn, Mo, Ni, Sb, Se, Sr, Tl, U, V, Zn) <sup>6</sup>	EPA Method 6010B	f, m, or a	One pipe and one soil samples	ea PB or AB <sup>2</sup>	NR	ea PB or AB	ea PB or AB	µg/g or µg/mL
ICP/MS <sup>3</sup>	<sup>237</sup> Np, <sup>233</sup> U, <sup>234</sup> U, <sup>235</sup> U, <sup>236</sup> U, <sup>238</sup> U, <sup>230</sup> Th, <sup>232</sup> Th	EPA Method 6020	f, m, or a	One pipe and one soil samples	ea PB or AB	NR	ea PB or AB	ea PB or AB	µg/g or µg/mL
Distillation/ISE	S <sup>2-</sup>	EPA Method 9030B/9215	d	One pipe and one soil samples	ea AB	NR	ea AB	ea AB	µg/g or µg/mL
Liquid scintillation	<sup>63</sup> Ni	Not available	f, m, or a	One pipe and one soil samples	NA	NR	ea PB or AB	ea PB or AB	µCi/g or µCi/mL
IC	Primary inorganics (F <sup>-</sup> , Cl <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , NO <sub>2</sub> <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> <sup>-</sup> , CHO <sub>2</sub> <sup>-</sup> , C <sub>2</sub> H <sub>3</sub> O <sub>3</sub> <sup>-</sup> , C <sub>2</sub> O <sub>4</sub> <sup>2-</sup> ) <sup>6</sup>	EPA Method 9056	w	One pipe and one soil samples	ea AB	NR	ea PB	ea AB	µg/g or µg/mL
IC	NH <sub>4</sub> <sup>+</sup>	EPA Method 300.7	dist	One pipe and one soil samples	ea PB	NR	ea PB	ea PB	µg/g or µg/mL
CVAA	Hg	EPA Method 7471A/7470A	d	One pipe and one soil samples	ea AB	NR	ea AB	ea AB	µg/g or µg/mL
Spectrophotometric	CN <sup>-</sup>	EPA Method 9010C	dist	One pipe and one soil samples	ea AB	NR	ea AB	ea AB	µg/g or µg/mL
Sep & beta count	<sup>90</sup> Sr	Not available	f or m	One pipe and one soil samples	NA	NR	ea AB	ea AB	µCi/g or µCi/mL



Table 5-1. Chemical, Radiological, and Physical Analytical Requirements for Samples. (3 sheets)

Instrument	Analyte	EPA Analytical Method	Prep method for solids (a/d/f/m/w/e/dist)	Quality control					
				Duplicate per Pipeline	Matrix spike	Matrix spike DUP	Blank	LCS	Units (for liquids or solids as appropriate)
Separation, AEA <sup>4</sup>	<sup>238, 239/240</sup> Pu, <sup>241</sup> Am, <sup>243/244</sup> Cm, <sup>242</sup> Cm	Not available	f or m	One pipe and one soil samples	NA	NR	ea AB	ea AB	μCi/g or μCi/mL
Sep/liquid scintillation	<sup>3</sup> H	Not available	w	One pipe and one soil samples	ea AB <sup>5</sup>	NR	ea PB	ea AB	μCi/g or μCi/mL
Sep/liquid scintillation	<sup>14</sup> C	Not available	w	One pipe and one soil samples	ea AB <sup>5</sup>	NR	ea PB	ea AB	μCi/g or μCi/mL
Anion-cation exchange/distillation/liquid scintillation	<sup>79</sup> Se	Not available	a or m	One pipe and one soil samples	NA	NA	ea PB or AB	Standard not available	μCi/g or μCi/mL
ICP/MS	<sup>99</sup> Tc	EPA Method 6020	f, m, or a	One pipe and one soil samples	ea AB	NR	ea PB or AB	ea PB or AB	μg/g or μg/mL
Sep/GEA	<sup>129</sup> I	Not available	f/w	One pipe and one soil samples	NA	NA	ea AB	ea AB	μCi/g or μCi/mL
GEA <sup>5</sup>	Primary gamma emitters: <sup>152, 154, 155</sup> Eu, <sup>137</sup> Cs, <sup>60</sup> Co, <sup>125</sup> Sb, <sup>226</sup> Ra	Not available	f or m	One pipe and one soil samples	NA	NA	ea AB	ea AB	μCi/g or μCi/mL

**Table 5-1. Chemical, Radiological, and Physical Analytical Requirements for Samples. (3 sheets)**

Instrument	Analyte	EPA Analytical Method	Prep method for solids (a/d/f/m/w/e/dist)	Quality control					
				Duplicate per Pipeline	Matrix spike	Matrix spike DUP	Blank	LCS	Units (for liquids or solids as appropriate)
GC/MS	Primary VOC (see Table 5-2)	EPA Method 8260B	d	One pipe and one soil samples	ea AB	ea AB	ea AB	ea AB	µg/L or µg/kg wet wt.
GC/MS	Primary SVOC (see Table 5-2)	EPA Method 8270C	e	One pipe and one soil samples	ea PB	ea PB	ea PB	ea PB	µg/L or µg/kg wet wt.
PH Meter	pH	EPA Method 9045D	d	One pipe and one soil samples	NA	NA	NA	ea AB	pH
GC/ECD	PCBs (Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260)	EPA Method 8082	e	One pipe and one soil samples	ea PB	ea PB	ea PB	ea PB	µg/L wet wt. or µg/kg dry wt.

**Notes:**

<sup>1</sup>Use SpG procedure when solids are too dry or are observed to contain significant air "pockets" that may affect accuracy or repeatability of the measurements. The LCS is applicable to the SpG analysis only.

<sup>2</sup>Serial dilutions or matrix spikes may be used as necessary.

<sup>3</sup>LCS and spike for <sup>232</sup>Th and <sup>235</sup>U only. Initial calibration verification and post-digest spike for <sup>232</sup>Th, <sup>237</sup>Np, <sup>235</sup>U, and <sup>238</sup>U.

<sup>4</sup>LCS for <sup>238/240</sup>Pu and <sup>241</sup>Am only.

<sup>5</sup>LCS for <sup>137</sup>Cs and <sup>60</sup>Co only.

<sup>6</sup>Mo, Cl, and SO<sub>4</sub> are not identified as TankFarm Process Waste Pipeline System constituents in D&D-30262 but were added during review of this SAP.

**Prep Method Abbreviations:**

e = extraction, d = direct, f = fusion, a = acid, w = water, dist = distillation, m = microwave, sep = separation

**Miscellaneous Abbreviations:**

ea = each, NA = not applicable, NR = not required, AB = analytical batch, PB = preparation batch, DUP = duplicate analyses

**Analytical Method Abbreviations:**

AEA = alpha energy analysis.  
 CVAA = cold vapor atomic absorption.  
 GC/ECD = gas chromatography/electron capture detector.  
 GC/MS = gas chromatography/mass spectrometry.  
 GEA = gamma energy analysis.  
 IC = ion chromatography.  
 ICP/AES = inductively coupled plasma/atomic emission spectrometry.  
 ICP/MS = inductively coupled plasma/mass spectrometry.  
 ISE = ion selective electrode.  
 LCS = laboratory control sample.  
 PCB = polychlorinated biphenyl.  
 SpG = specific gravity.  
 SVOC = semivolatile organic compound.  
 VOC = volatile organic compound.

**Table 5-2. Primary Organic Analytes**

Primary VOA analytes	CAS No.	Primary SVOA analytes	CAS No.
1,1,1-Trichloroethane	71-55-6	2-Methylphenol (o-cresol)	95-48-7
1,1,2,2-Tetrachloroethene	127-18-4	Butylbenzylphthalate	85-68-7
1,1,2,2-Tetrachloroethane	79-34-5	2,4,5 Trichlorophenol	95-95-4
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	2,4,6-Trichlorophenol	88-06-2
1,1,2-Trichloroethane	79-00-5	2,6-Bis(tert-butyl)-4-methylphenol	128-37-0
1,1,2-Trichloroethylene	79-01-6	2-Chlorophenol	95-57-8
1,1-Dichloroethene	75-35-4	2-Ethoxyethanol	110-80-5
1,2-Dichloroethane	107-06-2	4-Methylphenol (p-cresol)	106-44-5
Chloroethene (vinyl chloride)	75-01-4	Acenaphthene	83-32-9
2-Butanone (MEK)	78-93-3	Cresylic acid (cresol, mixed isomers)	1319-77-3
2-Nitropropane	79-46-9	Cyclohexanone	108-94-1
2-Propanone (Acetone)	67-64-1	Di-n-butylphthalate	84-74-2
4-methyl-2-pentanone (MIBK)	108-10-1	Di-n-octylphthalate	117-84-0
Benzene	71-43-2	N-nitroso-di-n-propylamine	621-64-7
Carbon disulfide	75-15-0	Fluoranthene	206-44-0
Carbon tetrachloride	56-23-5	o-Nitrophenol	88-75-5
Chlorobenzene	108-90-7	p-Chloro-m-cresol (4-Chloro-3-methylphenol)	59-50-7
Chloroform	67-66-3	m-Cresol (3-Methylphenol)	108-39-4
Dichloromethane (methylene chloride)	75-09-2	Pyrene	129-00-0
Ethyl acetate	141-78-6	N-Nitrosomorpholine	59-89-2
Ethylbenzene	100-41-4	1,2,4-Trichlorobenzene	120-82-1
Diethyl ether	60-29-7	2,4-Dinitrotoluene	121-14-2
Toluene	108-88-3	Hexachloroethane	67-72-1
trans-1,3,-Dichloropropene	542-75-6	Hexachlorobutadiene	87-68-3
Trichlorofluoromethane	75-69-4	Nitrobenzene	98-95-3
Xylenes	1330-20-7	Naphthalene	91-20-3
o-Xylene	95-47-6	o-Dichlorobenzene	95-50-1
m-Xylene	108-38-3	Pyridine	110-86-1
p-Xylene	106-42-3	Isobutanol	78-83-1
--	--	n-Butyl alcohol (1-butanol)	71-36-3
--	--	Tributyl phosphate	126-73-8
--	--	Dibutyl phosphate*	107-66-4
--	--	Monobutyl phosphate*	--
--	--	Benzo (a) anthracene*	56-55-3
--	--	Benzo (b) fluorathene*	205-99-2
--	--	Benzo (k) fluorathene*	207-08-9
--	--	Benzo (a) pyrene*	50-32-8

**Table 5-2. Primary Organic Analytes**

Primary VOA analytes	CAS No.	Primary SVOA analytes	CAS No.
--	--	Chrysene*	218-01-9
--	--	Dibenzo (ab) anthracene*	53-70-3
--	--	Indeno (123-cd) pyrene*	193-39-5

Note: \*This analyte is not identified as a Tank Farm Process Waste Pipeline System constituent in D&D-30262 but was added during the review of this SAP.

Abbreviations:

CAS = Chemical Abstracts Service.  
SVOA = semivolatile organic analysis.  
VOA = volatile organic analysis.

## 6.0 QUALITY ASSURANCE AND QUALITY CONTROL

Quality requirements for conducting River Protection Project (RPP) sampling and analysis are described in DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Documents*. ATL-MP-1011, *ATL Quality Assurance Project Plan for 222-S Laboratory* specifies the requirements for ensuring the quality of sample analysis conducted at the 222-S Laboratory. This quality assurance (QA) plan meets DOE/RL-96-68 minimum requirements as the baseline for laboratory quality systems.

All activities (sampling and analysis) will be performed using approved methods, procedures, and work packages that are written in accordance with approved operational and laboratory QA plans, which are consistent with the requirements of this SAP. Sampling and analysis activities shall be performed by qualified personnel using properly maintained and calibrated equipment.

### 6.1 FIELD QUALITY CONTROL

Field QC samples shall be collected to evaluate the potential for cross-contamination and laboratory performance. Field QC for sampling in the 200-IS-1 tank farm pipelines will require the collection of field duplicates, equipment rinsate blank, and trip blank samples, where appropriate. If possible, field duplicates should be collected from contaminated areas so valid comparisons between the samples can be made. However, the samples should not be collected from zones that are expected to contain high levels of transuranic-contaminated soils because of the high cost and added handling requirements associated with transuranic materials. Limited sample material is anticipated as being available within the interior of pipelines. Because of this situation, sufficient sample quantity may not be available for the collection of field QC samples and the percentage frequency goals specified for each type of field QC sample may not be achievable. Available sample material will always be prioritized for use in the analysis of the primary analytical samples. The field QC sample types and the frequency goals for collection are described in the following subsections.

#### Field Duplicates

Each field duplicate shall be retrieved from the sample interval or location using the same equipment (e.g., collected from same split-spoon or sample mixing bowl) and sampling technique as the original sample. Field duplicates for soil are collected and homogenized before being divided into two samples in the field. If volatile organic analysis (VOA) samples are required, they should be collected before homogenization. The duplicate samples shall be sent to the primary laboratory in the same manner as the routine site samples. Field duplicates provide information regarding the homogeneity of the sample matrix and can be used to evaluate the precision of the analysis process.

At least 5 percent of the total collected soil samples will be duplicated (one field duplicate will be collected for every 20 samples). At least one field duplicate shall be collected from the samples taken for each of the pipeline bins investigated. The duplicate samples shall be suitable

for analysis by an offsite laboratory and shall be analyzed for all of the COPCs listed in Table 5-1.

### **Field Splits**

Field split samples will be collected at the same frequency as field duplicate samples. Each split sample shall be retrieved from the same sample interval or location using the same equipment (e.g., collected from same one split-spoon or sample mixing bowl) and sampling technique as the original sample. Samples shall be homogenized, split into two separate aliquots in the field, and sent to two independent laboratories. If VOA samples are required, they should be collected before homogenization. The splits will be used to verify the performance of the primary laboratory.

The split samples will be obtained from a sample medium that is expected to have some contamination and that is suitable for analysis in an offsite laboratory and shall be analyzed for all of the COPCs listed in Table 5-1.

### **Equipment Rinsate Blanks**

Equipment rinsate blanks are used to verify the adequacy of sampling equipment decontamination procedures and shall be collected for each sampling method or type of equipment used. The field geologist can request that additional equipment blanks be taken. Equipment blanks shall consist of deionized water washed through decontaminated sampling equipment and placed in containers identified in the Sampling Authorization Forms. Note that the bottle and preservation requirements for water may differ from the requirements for soil. Equipment rinsate blanks shall be analyzed for the following:

- Gross alpha
- Gross beta
- Metals (excluding hexavalent chromium and mercury)
- Anions (except cyanide)
- VOAs of interest
- SVOAs of interest.

These analytes are considered the best indicators of decontamination effectiveness.

### **Trip Blanks**

The volatile organic trip blanks will constitute at least 5 percent of all volatile organic compound (VOC) samples. If applicable, at least one trip blank shall be collected for each of the pipeline bins. Trip blanks shall consist of laboratory-grade deionized water added to a clean sample container. The trip blanks shall travel to the field with the associated bottle sets and will be returned to the laboratory with the samples. They will remain unopened during their transport and handling. Trip blanks are prepared as a check for possible contamination originating from container preparation methods, shipment, handling, storage, or site conditions. The trip blank shall be analyzed for VOCs only.

### **Prevention of Cross-Contamination**

Special care should be taken to prevent cross-contamination of soil samples. Particular care will be exercised to avoid the following common ways in which cross-contamination or background contamination may compromise the samples:

- Improperly storing or transporting sampling equipment and sample containers
- Contaminating the equipment or sample bottles by setting them on or near potential contamination sources, such as uncovered ground
- Handling bottles or equipment with dirty hands
- Improperly decontaminating equipment before sampling or between sampling events.

## **6.2 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS FOR LABORATORY ANALYSIS**

Laboratories performing analyses in support of this SAP shall have approved and implemented QA plans. These QA plans shall meet the minimum requirements of DOE/RL-96-68 as the baseline for laboratory quality systems. Because Phase 1 sampling will focus on pipelines and soils exhibiting a high level of contamination, samples collected according to this SAP will be analyzed at the 222-S Laboratory in the 200 West Area. The 222-S Laboratory conducts sample analyses according to ATL-MP-1011, which meets the minimum requirements of DOE/RL-96-68.

### **6.2.1 Quality Control Requirements**

Required QC analyses (duplicates, matrix spikes, blanks, laboratory control samples) are identified in Table 5.1. The laboratory shall also use calibration and calibration check standards appropriate for the analytical instrumentation as defined in DOE/RL-96-68. The QC acceptance criteria for laboratory control samples, spikes, and duplicate are specified in the DQO (D&D-30262) and are summarized in Table 6.1. Laboratory blanks shall be evaluated against the method detection limits. The QC criteria are goals for demonstrating reliable method performance. The laboratory will use its internal QA system for addressing any QC failures. If the QC failures are systematic and cannot be resolved by the internal protocols, the project manager/assigned task lead shall be consulted to determine the proper action. The laboratory should suggest a course of action at that time. All data not meeting the QC requirements shall be properly noted and the associated QC failures discussed in the narrative section of the Format V data report.

**Table 6-1. Quality Control Parameters for Primary Analytes (2 Sheets)**

Analytes	Method	QC Acceptance Criteria		
		LCS % Recovery <sup>5</sup>	Spike % Recovery <sup>5</sup>	Duplicate/ MSD RPD <sup>1</sup>
Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Mo, Ni, Se, Ag, Sr, Tl, U, V, Zn	ICP/AES	70-130%	70-130%	≤30%
Hg	CVAA	70-130%	70-130%	≤30%
F <sup>-</sup> , NO <sub>2</sub> <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , Cl <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , NH <sub>4</sub> <sup>+</sup> , C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> <sup>-</sup> , CHO <sub>2</sub> <sup>-</sup> , C <sub>2</sub> H <sub>3</sub> O <sub>3</sub> <sup>-</sup> , C <sub>2</sub> O <sub>4</sub> <sup>2-</sup>	IC	70-130%	70-130%	≤30%
CN <sup>-</sup>	Spectrophotometric	70-130%	70-130%	≤30%
S <sup>2-</sup>	Distillation/ISE	70-130%	70-130%	≤30%
Bulk Density or SpG	Gravimetric	70-130% <sup>2</sup>	NA	≤30%
pH	pH meter	± 0.1 pH units	NA	NA
VOC	GC/MS	70-130%	70-130%	≤30%
SVOC	GC/MS	70-130%	70-130%	≤30%
PCBs	GC/ECD	70-130%	70-130%	≤30%
Weight percent water	Thermogravimetric	70-130%	NA	≤30%
<sup>233</sup> U, <sup>234</sup> U, <sup>235</sup> U, <sup>236</sup> U, <sup>238</sup> U, <sup>237</sup> Np, <sup>230</sup> Th, <sup>232</sup> Th	ICP/MS	70-130% <sup>3</sup>	70-130% <sup>3</sup>	≤30%
<sup>60</sup> Co, <sup>137</sup> Cs, <sup>226</sup> Ra	GEA	70-130%	NA	≤30%
<sup>152</sup> Eu, <sup>154</sup> Eu, <sup>155</sup> Eu, <sup>125</sup> Sb	GEA	NA	NA	≤30%
<sup>129</sup> I	GEA	70-130%	NA	≤30%
<sup>14</sup> C, <sup>3</sup> H	Liquid scintillation counting	70-130%	70-130%	≤30%
<sup>63</sup> Ni	Liquid scintillation counting	70-130%	NA	≤30%
<sup>90</sup> Sr	Beta counting	70-130%	NA	≤30%
<sup>99</sup> Tc	ICP/MS	70-130%	70-130%	≤30%
<sup>79</sup> Se	Liquid scintillation counting	NA	NA	≤30%
<sup>239/240</sup> Pu, <sup>241</sup> Am	Alpha counting	70-130%	NA	≤30%
<sup>241</sup> Pu	Calculation from <sup>238</sup> Pu and <sup>239/240</sup> Pu <sup>4</sup>	NA	NA	NA
<sup>228</sup> Th	Calculation from <sup>232</sup> U and <sup>232</sup> Th. <sup>232</sup> U to be calculated from U or U isotopes <sup>4</sup>	NA	NA	NA
<sup>238</sup> Pu, <sup>242</sup> Cm, <sup>243/244</sup> Cm	Alpha counting	NA	NA	≤30%

**Abbreviations:**

CVAA	Cold Vapor Atomic Absorption
GC/ECD	Gas chromatography/electron capture detection
GC/MS	Gas chromatography/mass spectrometry
GEA	Gamma Energy Analysis
IC	Ion Chromatography
ICP/AES	Inductively Coupled Plasma / Atomic Emission Spectroscopy
ICP/MS	Inductively Coupled Plasma / Mass Spectroscopy
ISE	Ion selective electrode
LCS	Laboratory control sample
MSD	matrix spike duplicate
NA	Not applicable



**Table 6-1. Quality Control Parameters for Primary Analytes (2 Sheets)**

Analytes	Method	QC Acceptance Criteria		
		LCS % Recovery <sup>5</sup>	Spike % Recovery <sup>5</sup>	Duplicate/ MSD RPD <sup>1</sup>
PCB	Polychlorinated biphenyl			
QC	quality control			
RPD	Relative percent difference			
SpG	Specific gravity			
SVOC	semi-volatile organic compound			
VOC	volatile organic compound			

Notes:

<sup>1</sup>If primary and duplicate results are available above detection limits, RPD will be based on these results.<sup>2</sup>LCS is applicable to SpG analysis only.<sup>3</sup>LCS and matrix spike for <sup>235</sup>U, <sup>237</sup>Np, <sup>238</sup>U, and <sup>232</sup>Th only.<sup>4</sup>Calculations will be performed by Process Engineering.<sup>5</sup>Laboratories must meet statistically based controls if more stringent.**6.2.2 Target Detection Limits**

D&D-30262 provides target detection limits for tank farms pipeline sample analysis. Limits for primary radionuclides and chemicals are shown in Table 6.2 and 6.3.

**Table 6-2. Target Detection Limits for Primary Radionuclides (2 Sheets)**

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method	Lowest Overall CUL (pCi/g)	Target Detection Limits (pCi/g)
14234-35-6	Antimony-125	Gamma GS	--	0.3
14596-10-2	Americium-241	Am-241 AEA	31.1	1
14762-75-5	Carbon-14	C-14 LSC (low level)	4.65	1
10045-97-3	Cesium-137	Gamma GS	6.2	0.1
10198-40-0	Cobalt-60	Gamma GS	1.4	0.05
15510-73-3	Curium-242	Am-241/Cu-244 AEA	--	1.0
15757-87-6	Curium-243	Am-241/Cu-244 AEA	110	1.0
13981-15-2	Curium-244	Am-241/Cu-244 AEA	744	1.0
14683-23-9	Europium-152	Gamma GS	3.3	0.1
15585-10-1	Europium-154	Gamma GS	3.0	0.1
14391-16-3	Europium-155	Gamma GS	125	0.1
15046-84-1	Iodine 129	Iodine-129-LSC	0.12	2
13994-20-2	Neptunium-237	ICP/MS	2.5	1

**Table 6-2. Target Detection Limits for Primary Radionuclides (2 Sheets)**

<b>Chemical Abstracts Service No. or Constituent Identifier No.</b>	<b>Analyte</b>	<b>Survey or Analytical Method</b>	<b>Lowest Overall CUL (pCi/g)</b>	<b>Target Detection Limits (pCi/g)</b>
13981-37-8	Nickel-63	Ni-63 LSC	4,026	30
13981-16-3	Plutonium-238	AEA	37.4	1
Pu-239/240	Plutonium-239/240	AEA	33.9	1
13982-63-3	Radium-226	Gamma GS	7.03	0.2
15758-85-9	Selenium-79	Selenium-79-LSC	197,000	10
Rad-Sr	Strontium-90	Strontium-89,90 - Total Sr - Gas Proportional Counting	4.5	1
14133-76-7	Technetium-99	ICP/MS	1.93	1
4-82-9	Thorium-228	TBD	7.73	1
14269-63-7	Thorium-230	ICP/MS	20.1	1
TH-232	Thorium-232		4.8	1
10028-17-8	Tritium	Tritium – H-3 LSC(mid level)	48.2	30
13966-29-5	Uranium-233/234	ICP/MS	1.1	1
15117-96-1	Uranium-235		101	1
U-238	Uranium-238		1.06	1
N/A	Gross cesium-137 counts	Portable NaI detector		3.1
N/A	Gross alpha	Portable contamination detector		100 d/min/ 100 cm <sup>2</sup>
N/A	Gross beta/gamma	Portable contamination detector		5,000 d/min/ 100 cm <sup>2</sup>

CUL= cleanup level

TBD = to be determined

GS = gamma spectroscopy.

LSC = liquid scintillation counter.

AEA = alpha energy analysis.

ICP/MS = inductively coupled plasma/mass spectrometry

**Table 6-3. Target Detection Limits for Primary Chemicals (5 Sheets)**

<b>Chemical Abstracts Service No. or Constituent Identifier No.</b>	<b>Analyte</b>	<b>Survey or Analytical Method</b>	<b>Lowest Overall CUL (mg/kg)</b>	<b>Target Detection Limits (mg/kg)</b>
7429-90-5	Aluminum	EPA Method 6010B	45.2	5
7440-36-0	Antimony	EPA Methods 6010B, 6020, or 200.8 (trace)	5	0.6
7440-38-2	Arsenic	EPA Methods 6010B, 6020, or 200.8	6.5	1
7440-39-3	Barium	EPA Methods 6010B, 6020, or 200.8	132	20
7440-41-7	Beryllium	EPA Methods 6010B, 6020, or 200.8	10	0.5
7440-43-9	Cadmium	EPA Methods 6010B, 6020, or 200.8	0.81	0.5
7440-47-3	Chromium (III)/ Chromium (total)	EPA Methods 6010B, 6020, or 200.8	42	1
7440-48-4	Cobalt	EPA Methods 6010B, 6020, or 200.8	20	2
7440-50-8	Copper	EPA Methods 6010B, 6020, or 200.8	50	1
7439-89-6	Iron	EPA Methods 6010B, 6020, or 200.8	152	5
7439-92-1	Lead	EPA Methods 6010B, 6020, or 200.8	50	5
7439-96-5	Manganese	EPA Methods 6010B, 6020, or 200.8	512	1.9*
7439-97-6	Mercury	EPA Methods 7470A, 7471A, 6020, or 200.8	0.33	0.2
7439-98-7	Molybdenum	EPA Methods 7470A, 7471A, 6020, or 200.8	2	19*
7440-02-0	Nickel	EPA Methods 6010B, 6020, or 200.8	30	4
7782-49-2	Selenium	EPA Methods 6010B, 6020, or 200.8	0.3	1
7440-22-4	Silver	EPA Methods 6010B, 6020, or 200.8	2	2
7440-24-6	Strontium	EPA Methods 6010B, 6020, or 200.8	2,920	1
7440-28-0	Thallium	EPA Methods 6010B, 6020, or 200.8	1	0.5

**Table 6-3. Target Detection Limits for Primary Chemicals (5 Sheets)**

<b>Chemical Abstracts Service No. or Constituent Identifier No.</b>	<b>Analyte</b>	<b>Survey or Analytical Method</b>	<b>Lowest Overall CUL (mg/kg)</b>	<b>Target Detection Limits (mg/kg)</b>
7440-61-1	Uranium	EPA Methods 200.8, 6020, or kinetic phosphorescence absorption	3.21	1
7440-62-2	Vanadium	EPA Methods 6010B, 6020, or 200.8	560	2.5
7440-66-6	Zinc	EPA Methods 6010B, 6020, or 200.8	86	1
57-12-5	Cyanide (includes ferrocyanide)	EPA Methods 9010C total cyanide or 335	0.8	0.5
16984-48-8	Fluoride	IC, EPA Method 9056 or 300.0	5.78	5
14797-55-8	Nitrate	IC, EPA Method 9056 or 300.0	40	2.5
14797-65-0	Nitrite	IC, EPA Method 9056 or 300.0	4	2.5
16887-00-6	Chloride	IC, EPA Method 9056 or 300.0	1000	0.3*
14808-79-8	Sulfate	IC, EPA Method 9056 or 300.0	1000	2.7*
71-50-1	Acetate	IC, EPA Method 9056 or 300.0	--	4.5*
64-18-6	Formate	IC, EPA Method 9056 or 300.0	--	10.0
79-14-1	Glycolate	IC, EPA Method 9056 or 300.0	---	3.8*
144-62-7	Oxalate	IC, EPA Method 9056 or 300.0	--	2*
18496-25-8	Sulfide	EPA Method 9030	--	5
NA	Ammonium (NH <sub>4</sub> )	EPA Method 300.7	9.23	0.5
67-64-1	Acetone	EPA Method 8260	28.9	0.02
71-43-2	Benzene	EPA Method 8260	0.00448	0.0015
75-15-0	Carbon disulfide	EPA Method 8260	5.65	0.005
56-23-5	Carbon tetrachloride	EPA Method 8260	0.00310	0.0015
108-90-7	Chlorobenzene	EPA Method 8260	0.874	0.005
67-66-3	Chloroform (trichloromethane)	EPA Method 8260	0.0381	0.005
108-94-1	Cyclohexanone	EPA Method 8270C	344	0.5
107-06-2	1,2-Dichloroethane	EPA Method 8260	0.00232	0.0015
75-35-4	1,1-Dichloroethylene	EPA Method 8260	0.000522	0.01
75-09-2	Dichloromethane (methylene chloride)	EPA Method 8260	0.0218	0.002
10061-02-6	Dichloropropene; 1,3,- (trans-)	EPA Method 8260	0.00141	0.005
141-78-6	Ethyl acetate	EPA Method 8015	59.5	5
60-29-7	Diethyl ether	EPA Method 8015, 8260	6.68	5

**Table 6-3. Target Detection Limits for Primary Chemicals (5 Sheets)**

<b>Chemical Abstracts Service No. or Constituent Identifier No.</b>	<b>Analyte</b>	<b>Survey or Analytical Method</b>	<b>Lowest Overall CUL (mg/kg)</b>	<b>Target Detection Limits (mg/kg)</b>
100-41-4	Ethyl benzene	EPA Method 8260	6.05	0.005
67-72-1	Hexachloroethane	EPA Method 8270C	0.125	0.33
108-10-1	Methyl isobutyl ketone (MIBK hexone)	EPA Method 8260	2.71	0.01
78-93-3	Methyl ethyl ketone (MEK)	EPA Method 8260	19.6	0.01
79-46-9	Nitropropane; 2-	EPA Method 8260	0.0000208	0.002*
79-34-5	Tetrachloroethane; 1,1,2,2-	EPA Method 8260	0.00123	0.005
127-18-4	Tetrachloroethene (PCE)	EPA Method 8260	0.000859	0.005
108-88-3	Toluene	EPA Method 8260	4.65	0.005
76-13-1	trichloro-1,2,2-trifluoroethane; 1,1,2-	EPA Method 8260	22,000	0.010
71-55-6	1,1,1-Trichloroethane (TCA)	EPA Method 8260	1.58	0.005
79-00-5	1,1,2-Trichloroethane	EPA Method 8260	0.00427	0.002
83-32-9	Acenaphthene	EPA Method 8270C	20	0.33
71-36-3	Butanol; n- (n-butyl alcohol)	EPA Method 8260, 8015	6.62	5
85-68-7	Butylbenzylphthalate	EPA Method 8270C	893	0.33
95-57-8	Chlorophenol; 2-	EPA Method 8270C	0.943	0.33
M + P CRESOL	Cresol; m + p (3/4-Methylphenol)	EPA Method 8270C	10.1	0.33
95-48-7	Cresol; o- (2-Methylphenol)	EPA Method 8270C	10.3	0.33
1319-77-3	Cresylic acid (cresol, mixed isomers)	EPA Method 8270C	--	0.5*
84-74-2	Dibutylphthalate (Di-n-butylphthalate)	EPA Method 8270C	2.2	0.33
117-84-0	Di-n-octylphthalate	EPA Method 8270C	0.524	0.33
95-50-1	Dichlorobenzene; 1,2- (ortho-)	EPA Method 8270C	7.03	0.33
121-14-2	Dinitrotoluene; 2,4-	EPA Method 8270C	0.189	0.33
110-80-5	Ethoxyethanol; 2-	TBD	25.7	TBD
206-44-0	Fluoranthene	EPA Method 8270C	631	0.33
87-68-3	Hexachlorobutadiene	EPA Method 8270C	0.605	0.33
78-83-1	Isobutyl alcohol (Isobutanol)	EPA Methods 8260 or 8015	19.4	5
128-37-0	methylphenol; 2,6-Bis(tert-butyl)-4-	EPA Method 8270C	--	1.2*

**Table 6-3. Target Detection Limits for Primary Chemicals (5 Sheets)**

<b>Chemical Abstracts Service No. or Constituent Identifier No.</b>	<b>Analyte</b>	<b>Survey or Analytical Method</b>	<b>Lowest Overall CUL (mg/kg)</b>	<b>Target Detection Limits (mg/kg)</b>
59-50-7	methylphenol; 4-Chloro-3- (p-Chloro-m-cresol)	EPA Method 8270C	4,000	0.33
91-20-3	Naphthalene	EPA Method 8270C	4.46	0.33
98-95-3	Nitrobenzene	EPA Method 8270C	0.026	0.33
88-75-5	Nitrophenol; o-	EPA Method 8270C	---	0.66
621-64-7	Nitroso-di-n-propylamine	EPA Method 8270C	0.000056	0.33
79-01-6	Trichloroethylene (TCE)	EPA Method 8260	7.21E-4	3.7E-4*
75-69-4	Trichlorofluoromethane	EPA Method 8260	28.4	0.01
75-04-1	Vinyl chloride	EPA Method 8260	0.000184	0.01
1330-20-7	Xylenes	EPA Method 8260	14.6	0.01
108-38-3	Xylene; m-	EPA Method 8260	84.4	5.1E-4*
95-47-6	Xylene; o-	EPA Method 8260	91.9	2.4E-4*
106-42-3	Xylene; p-	EPA Method 8260	172	5.1E-4*
120-82-1	1,2,4 - Trichlorobenzene	EPA Method 8270C	2.98	0.33
59-89-2	Nitrosomorpholine; N-	EPA Method 8270C	--	0.33
129-00-0	Pyrene	EPA Method 8270C	655	0.33
110-86-1	Pyridine	EPA Method 8270C	0.0746	0.66
95-95-4	Trichlorophenol; 2,4,5-	EPA Method 8270C	4	0.33
88-06-2	Trichlorophenol; 2,4,6-	EPA Method 8270C	0.0924	0.33
		EPA Method 8041		0.165
126-73-8	Tributyl phosphate	EPA Method 8270C	6.18	3.3
107-66-4	Dibutyl phosphate*	EPA Method 8270C	--	TBD
--	Monobutyl phosphate*	EPA Method 8270C	--	TBD
56-55-3	Benzo (a) anthracene*	EPA Method 8270C	0.856	0.33
205-99-2	Benzo (b) fluorathene*	EPA Method 8270C	1.37	0.33
207-08-9	Benzo (k) fluorathene*	EPA Method 8270C	13.7	0.33
50-32-8	Benzo (a) pyrene*	EPA Method 8270C	0.137	0.33
218-01-9	Chrysene*	EPA Method 8270C	95.6	0.33
53-70-3	Dibenzo (ab) anthracene*	EPA Method 8270C	0.137	0.33
193-39-5	Indeno (123-cd) pyrene*	EPA Method 8270C	1.37	0.33
2674-11-2	Aroclor 1016	PCBs, EPA Method 8082	0.092	0.02
11104-26-2	Aroclor 1221	PCBs, EPA Method 8082	0.092	0.02
11141-16-5	Aroclor 1232	PCBs, EPA Method 8082	0.092	0.02

**Table 6-3. Target Detection Limits for Primary Chemicals (5 Sheets)**

<b>Chemical Abstracts Service No. or Constituent Identifier No.</b>	<b>Analyte</b>	<b>Survey or Analytical Method</b>	<b>Lowest Overall CUL (mg/kg)</b>	<b>Target Detection Limits (mg/kg)</b>
53969-21-9	Aroclor 1242	PCBs, EPA Method 8082	0.0394	0.02
126572-29-6	Aroclor 1248	PCBs, EPA Method 8082	0.0386	0.02
11097-6999-1	Aroclor 1254	PCBs, EPA Method 8082	0.066	0.02
11096-82-5	Aroclor 1260	PCBs, EPA Method 8082	0.072	0.02

Note: \*Target detection limit for this analyte is not specified in D&D-30262. It is based on detection limits achieved in the recent analyses of soil samples taken near tank 241-S-102 (RPP-RPT-36439, *Final Report for the Contaminated Soil Samples at Tank 241-S-102 in Support of the Type A Investigation of the Tank Waste Spill*).

Abbreviations:

CUL = cleanup level.  
EPA = U.S. Environmental Protection Agency.  
IC = ion chromatography.  
TBD = to be determined  
N/A = not applicable.  
PCB = polychlorinated biphenyl.

## **7.0 DATA REPORTING**

The data package(s) from the 222-S Laboratory will be in Format V. A Format V data package, as defined in ATL-MP-1011 is necessary because the data are expected to receive extensive review from external individuals and organizations. The Format V data package is subject to internal laboratory QA verification and review including peer review prior to release. Upon release, the data package will receive a third party validation.

The Format V data package requires a comprehensive report of analytical data. All analytical data, including waste sample analyses, blank analyses, holding time checks, matrix spike duplicate analyses, and surrogate recoveries shall be verified by the laboratory prior to reporting. The data package shall also include TICs found in volatile organic analysis (VOA) and semivolatile organic analysis (SVOA). A discussion of the TIC evaluation process shall be provided in the narrative.

In addition to the data package(s), an electronic version of the analytical results shall be provided to the Hanford Environmental Information System (HEIS) database.

## **8.0 CHANGE CONTROL**

Field activity and laboratory work scope changes may be required because of unexpected field conditions, new information, health and safety concerns, or other circumstances. Changes to work scope may result in modifications to this SAP. Work scope changes that do not result in deviation from the SAP requirements, can be made in the field or laboratory with the approval of the project manager or assigned task lead. These work scope changes will be documented in the sampling work package and/or Format V laboratory report and the retrieval data report. Justification for the changes to work scope shall be provided in sufficient detail to understand the basis for the change. Alternately, if field or laboratory conditions result in substantial work scope changes, the SAP may be revised with DOE and Ecology approval.

Waste sampling and field measurement methods and analytical strategies (e.g., constituent listings and data analysis) may be updated as new technologies or information become available. The impact of these updates to the SAP will be judged as they are identified to determine if revisions to the SAP will be necessary. Ecology, DOE and its contractors will participate in the SAP update evaluation process and any subsequent revisions to the SAP.



## 9.0 REFERENCES

- 10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste," *Code of Federal Regulations*, as amended.
- 40 CFR 268, "Land Disposal Restrictions," *Code of Federal Regulations*, as amended.
- ATL-MP-1011, 2007, *ATL Quality Assurance Project Plan for 222-S Laboratory*, as revised, Advanced Technologies and Laboratories International, Inc., Richland, Washington.
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- DOE/RL-96-81, *Waste Site Grouping for 200 Areas Soil Investigations*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- DOE/RL-98-28, *200 Areas Remediation Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- D&D-30262, 2006, *Data Quality Objectives Summary Report for the 200-IS-1 Operable Unit Pipelines and Appurtenances*, Rev. 0, Fluor Hanford, Inc., Richland, Washington.
- Ecology, EPA, DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, as amended, U.S. Environmental Protection Agency, U.S. Department of Energy, and Washington State Department of Ecology, Olympia, Washington.
- EPA, 1986, *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods*, SW-846, as amended, <http://www.epa.gov/epaoswer/hazwaste/test/main.htm>, U.S. Environmental Protection Agency, Washington, D. C.
- EPA/625/R-92/007, 1993, *Use of Airborne, Surface, and Borehole Geophysical Techniques at Contaminated Sites: A Reference Guide*, U.S. Environmental Protection Agency, Washington, D.C.
- Fluor 2007, Waste Information Data System, <http://www2.re.gov/phmc/cp/wids>, Fluor Hanford, Inc., Richland, Washington.
- RPP-RPT-28955, 2006, *Surface Geophysical Exploration of T Tank Farm at the Hanford Site*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.
- RPP-RPT-36439, 2008, *Final Report for the Contaminated Soil Samples at Tank 241-S-102 in Support of the Type A Investigation of the Tank Waste Spill*, as revised, Advanced Technologies and Laboratories International, Inc., Richland, Washington.
- WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.

**APPENDIX A**

**QUALITY ASSURANCE PROJECT PLAN FOR PHASE 1 SAMPLING AND  
ANALYSIS OF THE 200-IS-1 OPERABLE UNIT TANK FARM PIPELINES**

## **QUALITY ASSURANCE PROJECT PLAN FOR PHASE 1 SAMPLING AND ANALYSIS OF THE 200-IS-1 OPERABLE UNIT TANK FARM PIPELINES**

The quality assurance project plan (QAPjP) establishes the quality requirements for environmental data collection, including sampling, field measurements, and laboratory analysis. The QAPjP complies with the requirements of the following:

- U.S. Department of Energy (DOE) Order 414.1C, *Quality Assurance*
- 10 CFR 830.120, "Quality Assurance Requirements"
- EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5.

### **A-1.0 PROJECT MANAGEMENT**

This section addresses the basic areas of project management, and it ensures that the project has a defined goal, that the participants understand the goal and approach to be used, and that the planned outputs have been appropriately documented. The QAPjP is organized according to the elements described in EPA QA/R-5.

#### **A-1.1 PROJECT/TASK ORGANIZATION**

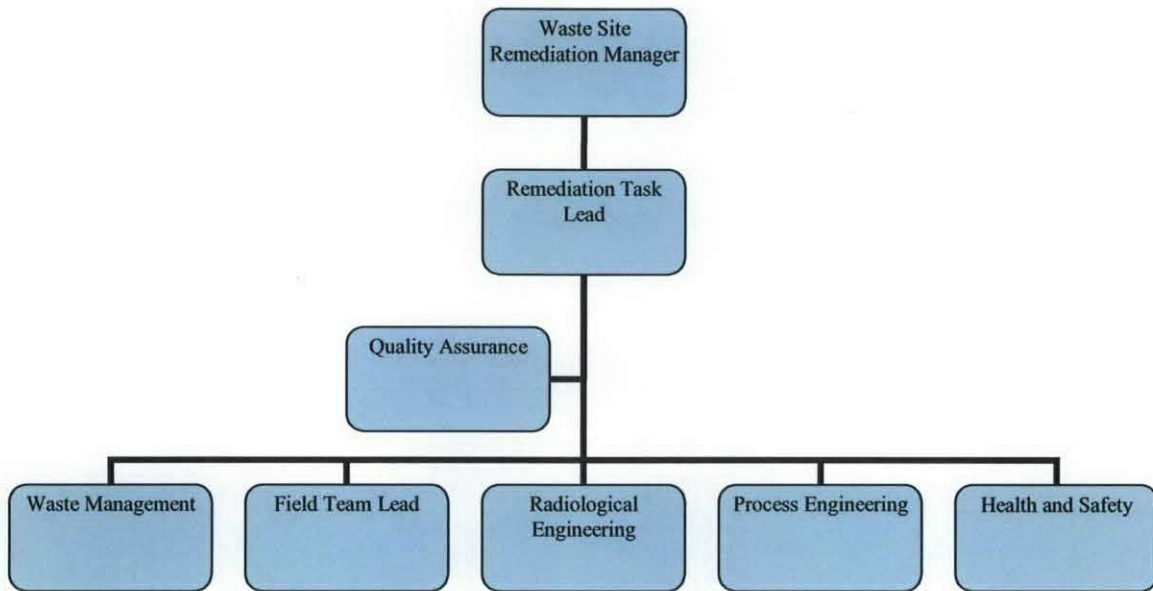
The project organization is described in the subsections that follow and is shown in Figure A-1.

##### **Waste Site Remediation Manager**

The Waste Site Remediation manager provides oversight for all activities and coordinates with DOE and Ecology in support of sampling activities. In addition, support is provided to the task lead to ensure that the work is performed safely and cost-effectively.

##### **Remediation Task Lead**

The Remediation task lead is responsible for direct management of sampling documents and requirements, field activities, and subcontracted tasks. The task lead ensures that the field team lead, samplers, and others responsible for implementation of this SAP and the QAPjP are provided with current copies of this document and any revisions thereto. The task lead works closely with quality assurance, health and safety, and the field team leader to integrate these and the other lead disciplines in planning and implementing the work scope. The task lead also coordinates with and reports to DOE, Ecology, and the Tank Farm contractor on all sampling activities.

**Figure A-1. Project Organization**

### **Quality Assurance**

Quality Assurance is responsible for quality assurance issues on the project. Responsibilities include oversight of implementation of the project quality assurance requirements; review of project documents, including SAPs (and the QAPjP); and participation in quality assurance assessments and surveillances on sample collection and analysis activities, as appropriate.

### **Waste Management**

The Waste Management lead communicates policies and procedures and ensures project compliance for storage, transportation, disposal, and waste tracking in a safe and cost-effective manner. Other responsibilities include identifying waste management sampling/characterization requirements to ensure regulatory compliance interpretation (e.g., with WAC 173-303) of the characterization data to generate waste designations, profiles, and other documents that confirm compliance with waste disposal requirements.

### **Field Team Leader**

The field team leader has the overall responsibility for the planning, coordination, and execution of the field sampling activities. Specific responsibilities include converting the sampling design requirements into field task instructions that provide specific direction for field activities. Responsibilities also include directing training, mock-ups, and practice sessions with field personnel to ensure that the sampling design is understood

and can be performed as specified. The field team leader communicates with the Remediation task lead to identify field constraints that could affect the sampling design. In addition, the field team leader directs the procurement and installation of materials and equipment needed to support the field work.

The field team leader oversees field-sampling activities that include sample collection, packaging, provision of certified clean sampling bottles/containers, documentation of sampling activities in controlled logbooks, chain-of-custody documentation, and packaging and transportation of samples to the laboratory or shipping center.

### **Radiological Engineering**

The Radiological Engineering lead is responsible for the radiological engineering and health physics support within the project. Specific responsibilities include conducting ALARA reviews, exposure and release modeling, and radiological controls optimization for all work planning. In addition, radiological hazards are identified and appropriate controls are implemented to maintain worker exposures to the hazards ALARA. Radiological Engineering interfaces with the project safety and health representative and plans and directs radiological control technician support for all activities.

### **Process Engineering**

Process Engineering prepares this SAP and individual pipeline sampling and analysis plans (PSAPs). Process Engineering selects the laboratories that perform the analyses and requests assessments/surveillances of the laboratories. This organization receives the analytical data from the laboratories, arranges for data entry into the Hanford Environmental Information System (HEIS) database, and arranges for data validation. It performs reviews of sample data against existing knowledge and data quality assessments according to guidelines in EPA QA/G-9, *Guidance for Data Quality Assessment*.

### **Health and Safety**

Responsibilities include coordination of industrial safety and health support within the project as carried out through safety and health plans, job hazard analyses, and other pertinent safety documents required by Federal regulation or by internal Tank Farm Contractor work requirements. In addition, assistance is provided to project personnel in complying with applicable health and safety standards and requirements. Personnel protective clothing requirements are coordinated with Radiological Engineering.

## **A-1.2 PROBLEM DEFINITION/BACKGROUND**

See Sections 1.0 and 2.0 of the SAP.

### **A-1.3 PROJECT/TASK DESCRIPTION**

See Section 3.0 of the SAP.

### **A-1.4 QUALITY OBJECTIVES AND CRITERIA**

See Sections 5.0 and 6.0 of the SAP.

### **A-1.5 SPECIAL TRAINING/CERTIFICATION**

Sampling and laboratory personnel shall complete the necessary training and receives appropriate certification to perform assigned tasks in support of the 200-IS-1 characterization project. The environmental safety and health training program provides workers with the knowledge and skills necessary to safely execute assigned duties. Field personnel typically will have completed the following training before starting work:

- Occupational Safety and Health Administration 40-hour hazardous waste worker training and supervised 24-hour hazardous waste site experience
- 8-hour hazardous waste worker refresher training (as required)
- Hanford general employee radiation training
- Radiological worker training.

A graded approach is used to ensure that workers receive a level of training commensurate with their responsibilities that complies with applicable U.S. Department of Energy orders and government regulations. Specialized employee training includes prejob briefings, on-the-job training, emergency preparedness, plan-of-the-day activities, and facility/worksites orientations.

### **A-1.6 DOCUMENTS AND RECORDS**

All information pertinent to field sampling and surveying will be recorded in field checklists and bound logbooks in accordance with existing sample collection protocols. The sampling team will be responsible for recording all relevant sampling information. Entries made in the logbook will be dated and signed by the individual who made the entry. Program requirements for managing the generation, identification, transfer, protection, storage, retention, retrieval, and disposition of records within the Tank Farms Contractor will be followed.

Requirements for laboratory data reporting are discussed in Sections 7.0 and 8.0 of the SAP.

## **A-2.0 DATA GENERATION AND ACQUISITION**

### **A-2.1 SAMPLING PROCESS DESIGN**

See Section 4.1 of the SAP.

### **A-2.2 SAMPLING METHODS**

See Section 4.2 of the SAP.

### **A-2.3 SAMPLE HANDLING AND CUSTODY**

See Section 4.3 of the SAP.

### **A-2.4 ANALYTICAL METHODS**

See Table 5.1 of the SAP.

### **A-2.5 QUALITY CONTROL**

Quality control sample requirements and acceptance criteria for these samples are specified in Section 6.0 of the SAP. Overall quality assurance and quality control requirements for characterization are discussed in this section.

#### **A-2.5.1 Quality Assurance Objective**

The quality assurance objective of this plan is to develop implementation guidance that will provide data of known and appropriate quality. Data quality is assessed by representativeness, comparability, accuracy, and precision. The applicable QC guidelines, quantitative target limits, and levels of effort for assessing data quality are dictated by the intended use of the data and the nature of the analytical method. Each of these is addressed in the following subsections:

##### **Representativeness**

Representativeness is a measure of how closely the results reflect the actual concentration and distribution of the chemical and radiological constituents in the matrix sampled. Sampling design has been developed and sampling techniques will be selected with the goal of optimizing representativeness of the samples.

##### **Comparability**

Comparability expresses the confidence with which one data set can be compared to another. Data comparability will be maintained using standard procedures and consistent

methods and units. Also, split samples will be used to compare performance of laboratories.

### **Accuracy**

Accuracy is an assessment of the closeness of the measured value to the true value. Accuracy of chemical test results is assessed by spiking samples with known standards and establishing the average recovery. A matrix spike is the addition to a sample of a known amount of a standard compound similar to the compounds being measured. Sample accuracy is expressed as the percent recovery of a spiked sample. Table 6-1 provides the accuracy criteria for laboratory analyses.

### **Precision**

Precision is a measure of the data reproducibility when more than one measurement has been taken on the same sample. Precision can be expressed as the relative percent difference for duplicate measurements or relative standard deviation for triplicates. Table 6.1 lists the analytical precision criteria for fixed laboratory analyses.

### **Detection Limits**

Detection limits are functions of the analytical method used to provide the data and the quantity of the sample available for analyses. Method detection limits for the COPCs are presented on Tables 6-2 and 6-3.

### **Laboratory Quality Control**

The laboratory method blanks, duplicates, laboratory control sample/blank spike, and matrix spikes are defined in Chapter 1 of SW-846 and will be run at the frequency specified in Chapter 1 of SW-846. Because of anticipated limited sample quantity being available within the pipelines, sufficient material may be available to perform both method analysis and associated laboratory QC. Available sample quantity will always be prioritized and allocated to completion of the method analysis. If insufficient sample is available for completion of laboratory QC analyses, the laboratory will be make note of the condition in the data package narrative and the associated data results will have laboratory qualifies added as appropriate.

### **A-2.5.3 Sample Preservation, Containers, and Holding Times**

Sample preservation, containers, and holding times for radiological and nonradiological analytes are shown in Table A-1.



**Table A-1. Sample Preservation, Container, and Holding Time Guidelines**

Analytes	Matrices	Bottle		Preservation	Packing Requirements	Holding Time
		Number	Type			
Radionuclides	Soil/Sludge/ Sediment/Scale	1	G/P	None	None	6 months
IC anions	Soil/Sludge/ Sediment/Scale	1	G/P	None	Cool 4 °C	48 hours
ICP metals	Soil/Sludge/ Sediment/Scale	1	G/P	None	None	6 months
Mercury	Soil/Sludge/ Sediment/Scale	1	G	None	None	28 days
Total cyanide	Soil/Sludge/ Sediment/Scale	1	G	None	Cool 4 °C	14 days
pH (soil)	Soil/Sludge/ Sediment/Scale	1	G/P	None	None	Within 24 hrs of lab receipt
SVOA	Soil/Sludge/ Sediment/Scale	1	AG	None	Cool 4 °C	14/40 days
VOA	Soil/Sludge/ Sediment/Scale	2 - 8	aGs	Methanol (high level) Freeze (low level)	Methanol Cool 4 °C; Freeze < - 7°C and > -20°C	14 days
PCBs	Soil/Sludge/ Sediment/Scale	1	G	None	Cool 4 °C	14 days

AG = amber glass

CVAA = cold vapor atomic absorption

EPA = U.S. Environmental Protection Agency

G = glass

GC = gas chromatography

IC = ion chromatography

ICP = inductively coupled plasma

P = plastic

PCB = polychlorinated biphenyl

SVOA = semivolatile organic analysis

VOA = volatile organic analysis

#### **A-2.5.4 Sample Collection Requirements**

##### **Sample Location**

Pipeline and soil sample locations are selected as described in Section 4.0 of the SAP. Minor adjustments to the specified locations may be made to mitigate unsafe conditions, avoid structural interferences, or bypass utilities. Changes in sample locations that do not affect the DQOs will require approval of Process Engineering and the task lead. Changes to sample locations that result in impacts to the DQOs will require concurrence by DOE and Ecology.

Surface geophysical and radiation surveys will be conducted at all sample locations. The surface geophysical surveys will be conducted using ground-penetrating radar and/or electromagnetic imaging and will aid in verifying the locations of buried pipelines and in selecting soil probe locations to avoid subsurface obstructions. The surface radiation surveys will identify areas of surface contamination that might affect health and safety of the workers.

##### **Sample Identification**

The sample and data-tracking database will be used to track the samples from the point of collection through the collection and laboratory analysis process. The HEIS database is the repository for the laboratory analytical results. The HEIS sample numbers will be issued to the sampling organization for this project in accordance with onsite organizational procedures. Each radiological/nonradiological and physical properties sample will be identified and labeled with a unique HEIS sample number. The sample location, depth, and corresponding HEIS numbers will be documented in the sampler's field logbook.

Each sample container will be labeled with the following information using a waterproof marker on firmly affixed water-resistant labels:

- Sample identification number
- Sample collection date and time
- Name or initials of person collecting the sample
- Preservation method (if applicable).

A list of sample analyses is not required for sample labels because the list could be quite long. The laboratory will consult the PSAPs for appropriate analyses and additional guidance for preparing the sample for analysis.

##### **Sample Custody**

See Section 4.3 of the SAP.

### **Sample Containers and Preservatives**

Level I EPA pre-cleaned sample containers will be used for soil samples collected for chemical and radiological analysis. Container sizes may vary depending on laboratory-specific volumes/requirements for meeting analytical detection limits. If, however, the dose rate on the outside of a sample jar or the curie content within the sample exceeds levels acceptable by an offsite laboratory, the sampling lead can send smaller volumes to the laboratory.

### **Sample Shipping**

The radiological control technician will measure the contamination levels on the outside of each sample jar and the dose rates on each sample jar. The radiological control technician also will measure the radiological activity on the outside of the sample container (through the container) and will document the highest contact radiological reading in millirem per hour. This information, along with other data, will be used to select proper packaging, marking, labeling, and shipping paperwork in accordance with U.S. Department of Transportation regulations (49 CFR, "Transportation") and to verify that the sample can be received by the analytical laboratory in accordance with the laboratory's acceptance criteria.

## **A-2.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE**

Measurement and testing equipment used in the field or in the laboratory that directly affects the quality of analytical data will be subject to preventive maintenance measures to ensure minimization of measurement system downtime. Laboratories and onsite measurement organizations must maintain and calibrate their equipment per manufacturer or other applicable guidelines. Maintenance requirements (such as parts lists and documentation of routine maintenance) will be included in the individual laboratory and the onsite organization quality assurance plan or operating procedures (as appropriate). Calibration of laboratory instruments will be performed in a manner consistent with SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, or with auditable U.S. Department of Energy Hanford Site-wide and contractual requirements.

Consumables, supplies, and reagents will be reviewed in accordance with SW-846 requirements and will be appropriate for their use. Note that contamination is monitored by the QC samples discussed in Section 6.1 of the SAP.

## **A-2.7 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY**

See Sections 7.2 and A-2.6.

## **A-2.8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES**

See Section A-2.6.

## **A-2.9 NON-DIRECT MEASUREMENTS**

See Section 4.1 for a discussion on use of NDA.

## **A-2.10 DATA MANAGEMENT**

Data generated as a result of sampling and data analysis activities will follow requirements outlined in this QAPjP and shall be managed and stored in accordance with applicable programmatic requirements governing data management procedures. At the direction of the task lead, all analytical data packages shall be subject to final technical review by qualified personnel before the results are submitted to the regulatory agencies or before inclusion in reports. Electronic data access, when appropriate, shall be via a database (e.g., HEIS or a project-specific database). Where electronic data are not available, hard copies shall be provided in accordance with Section 9.6 of the *Hanford Federal Facility Agreement and Consent Order* (Ecology, EPA, and DOE. 1989).

Planning for sample collection and analysis shall be in accordance with the programmatic requirements governing laboratory sample collection activities. In the event that specific procedures do not exist for a particular work evolution, or if it is determined that additional guidance to complete certain tasks is needed, a work package will be developed to adequately control the activities, as appropriate. Examples of the sample teams' requirements include the activities associated with the following:

- Chain of custody/sample analysis requests
- Project and sample identification for sampling services
- Control of certificates of analysis
- Logbooks, checklists
- Sample packaging and shipping.

Approved work control packages and procedures will be used to document radiological measurements when implementing this SAP. Examples of the types of documentation for field radiological data include the following:

- Instructions regarding the minimum requirements for documenting radiological controls information as discussed in 10 CFR 835, "Occupational Radiation Protection"
- Instructions for managing the identification, creation, review, approval, storage, transfer, and retrieval of Hanford Site radiological records
- The minimum standards and practices necessary for preparing, performing, and retaining radiological-related records
- The indoctrination of personnel on the development and implementation of survey/sample plans

- The requirements associated with preparing and transporting regulated material.

### **A-3.0 ASSESSMENT AND OVERSIGHT**

#### **A-3.1 ASSESSMENT AND RESPONSE ACTIONS**

Project management and Quality Assurance may conduct random surveillance and assessments to verify compliance with the requirements outlined in this SAP, project work packages, the project quality management plan, procedures, and regulatory requirements. Deficiencies identified by these assessments shall be reported in accordance with existing programmatic requirements. Corrective actions will be implemented as required by the Tank Farms Contractor policy and procedures.

#### **A-3.2 REPORTS TO MANAGEMENT**

Management will be made aware of deficiencies identified by assessments and surveillances and subsequent corrective actions.

## **A-4.0 DATA VALIDATION AND USABILITY**

### **A-4.1 DATA REVIEW, VERIFICATION, AND VALIDATION**

Sample data will be reviewed against existing knowledge of the characteristics and/or composition of the type(s) of waste that was transferred through the pipes. See Section 4.1 for additional discussion of process knowledge. Verification activities include checking completeness of laboratory analytical data packages (e.g., complete laboratory QC documentation, all data results present, data narrative summary is complete, and all report pages are present). Validation shall be performed on completed data packages by a qualified independent contractor. Validation shall consist of verifying required deliverables, requested versus reported analyses, and transcription errors. Validation also shall include the evaluation and qualification of results based on holding time, method blanks, matrix spikes, laboratory control samples, laboratory duplicates, and chemical and tracer recoveries, as appropriate to the methods used. At least 5 percent of all data shall be validated. No validation will be performed for physical data, field measurements, or NDA results.

### **A-4.2 VERIFICATION AND VALIDATION METHOD**

See above section (Section A-4.1).

### **A-4.3 RECONCILIATION WITH USER REQUIREMENTS**

The data quality assessment process compares completed field-sampling activities to those proposed in corresponding sampling documents and provides an evaluation of the resulting data. The purpose of the data evaluation is to determine if quantitative data are of the correct type and are of adequate quality and quantity to meet the project DQOs. Data quality assessment will be performed according to guidelines in EPA/600/R-96/084, *Guidance for Data Quality Assessment, Practical Methods for Data Analysis*, EPA QA/G-9.

**A-5.0 QUALITY ASSURANCE PROJECT PLAN REFERENCES**

- 10 CFR 830.120, "Quality Assurance Requirements," Title 10, *Code of Federal Regulations*, Part 830.120, as amended.
- 10 CFR 835, "Occupational Radiation Protection," Title 10, *Code of Federal Regulations*, Part 835, as amended.
- 49 CFR, "Transportation," Title 49, *Code of Federal Regulations*, as amended.
- DOE Order 414.1C, *Quality Assurance*, U.S. Department of Energy, Washington, D.C.
- Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington, as amended.
- EPA, 2000, *Guidance for Data Quality Assessment, Practical Methods for Data Analysis*, EPA QA/G-9, QA00 Update, U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 2001, *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5, U.S. Environmental Protection Agency, Quality Assurance Division, Washington, D.C.
- SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, as amended by Updates I [July 1992], IIA [August 1993], IIB [January 1995], and III), Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.
- WAC 173-303, "Dangerous Waste Regulations", *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.